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163. Proposed by **R. D. CARMICHAEL**, Anniston, Ala.

In a regular n-gon a triangle is formed by taking three vertices at random. What is the mean value of the triangle?

No solution has been received.

164. Proposed by **J. O. MAHONEY, B. E., M. Sc.**, Central High School, Dallas, Tex.

If m is prime, and the numbers $0, 1, 2, \ldots\ldots\ldots, m^2-1$ are placed at random in the form of a square, the probability that the square is hyper-magic is $(m-1)m/(m^2-2)!$

No solution has been received.

167. Proposed by **PROF. R. D. CARMICHAEL**, Anniston, Ala.

A line l is divided into n segments by $n-1$ points taken at random on it; find the mean value of the product of p of the segments, the p segments being taken at random and p being less than n.

Solution by the PROPOSER.

Let a, b, c, ... be the p segments in some particular case. The chance that another point taken at random shall fall on the first of these segments is a/l; on the second, b/l; and so on. Hence the chance in this particular case that p new points taken at random will fall each on one of the p segments a, b, c, ... in an assigned order is $abc\ldots/l^p$. The chance that they shall so fall in any order is evidently $p!abc\ldots/l^p$. Hence the probability of this occurring, however the line is divided and however the p points are chosen, is $p!m(abc\ldots)/l^p$.

If now we can find another expression involving no unknown quantity and giving this same probability, the two will enable us to determine the value of $m(abc\ldots)$.

The number of ways in which p points can be taken one on each of p chosen segments is the same as the number of ways in which $p-1$ points can be placed one between the two of each consecutive pair of p other points, and is easily found by the theory of permutations to be $p!(p-1)!$. But p segments may be chosen from n segments in $\dfrac{n!}{p!(n-p)!}$ ways. Hence the whole number of ways in which p points can be chosen on n segments one on each of p segments is

$$\frac{p!(p-1)!\,n!}{p!(n-p)!}=\frac{n!(p-1)!}{(n-p)!}.$$

Now the whole number of ways in which $n-1+p$ points can be arranged is $(n+p-1)!$. Hence the chance that no two of the p points last chosen shall be on the same one of the original n segments is

$$\frac{n!(p-1)!}{(n-p)!}\div(n+p-1)!=\frac{n!(p-1)!}{(n-p)!(n+p-1)!}.$$

But this is the same chance as that which was found above in different terms. Equating the two, we have

$$\frac{p!\,m(abc...)}{l^p}=\frac{n!(p-1)!}{(n-p)!(n+p-1)!}.$$

Hence, $m(abc...)=\dfrac{l^p.n!(p-1)!}{p!(n-p)!(n+p-1)!}$.

For the case $p=n$ this value reduces to $\dfrac{l^n(n-1)!}{(2n-1)!}$, the mean value of the product of the n segments of the line. This result agrees with that found by Mr. Crofton in the solution of the latter problem in the Encyclopedia Britannica, Vol. XIX, p. 784.

This solution should have appeared instead of the solution published last month. Both solutions were received before the last issue went to press. By an oversight the defective solution got in with the material for publication. Ed. F.

170. Proposed by LON C. WALKER, Santa Barbara, Cal.

Find the area of a triangle formed by drawing a line at random through each of three points taken at random within a given triangle.

No solution has been received.

174. Proposed by J. EDWARD SANDERS, Reinersville, Ohio.

A chord of length C is drawn at random in a given ellipse. What is the average area of the segment cut off by the chord?

Solution by G. B. M. ZERR, A. M., Ph. D., Parsons, W. Va.

Refer the ellipse to conjugate diameters so that $x^2/m^2+y^2/n^2=1$ is its equation.

$$\text{Area of segment}=\frac{2n}{m}\sin\omega\int_{(m/2n)\sqrt{(4n^2-c^2)}}^{m}\sqrt{(m^2-x^2)}dx$$

$$=mn\sin\omega\left[\cos^{-1}\left(\frac{\sqrt{(4n^2-c^2)}}{2n}\right)-\frac{c\sqrt{(4n^2-c^2)}}{4n^2}\right]$$

$$=ab\left[\cos^{-1}\left(\frac{\sqrt{(4n^2-c^2)}}{2n}\right)-\frac{c\sqrt{(4n^2-c^2)}}{4n^2}\right]=A.$$

ω is the inclination of m, n.

$$\text{Average area is } \Delta=\frac{\int_b^a A\,dn}{\int_b^a dn}.$$